OP. 3100. 2. 255

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND
SCOTTISH HOME AND HEALTH DEPARTMENT

# ANTIBIOTICS IN MILK IN GREAT BRITAIN

## Report of the Milk Hygiene Sub-Committee of the Milk and Milk Products Technical Advisory Committee

*LONDON*
HER MAJESTY'S STATIONERY OFFICE
1963
PRICE 1*s.* 3*d.* NET

This report on antibiotics in milk in Great Britain was prepared by the Milk Hygiene Sub-Committee of the Milk and Milk Products Technical Advisory Committee.

The Milk and Milk Products Technical Advisory Committee was appointed in 1954 by the then Minister of Food, Minister of Agriculture and Fisheries, and Secretary of State for Scotland. It is responsible for keeping under review the technical problems arising at all stages of the handling, processing and distribution of milk and the manufacture of milk products; for informing Ministers of the problems requiring research and of desirable technical developments; and for advising on the best means of encouraging the adoption of such developments in the dairy industry. The present Chairman is Mr. E. Capstick, O.B.E., M.C.

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MILK AND MILK PRODUCTS TECHNICAL ADVISORY COMMITTEE

MILK HYGIENE SUB-COMMITTEE

# REPORT ON ANTIBIOTICS IN MILK IN GREAT BRITAIN

## PREFACE

Antibiotic preparations are widely used as the most effective treatment at present available for mastitis, an infectious disease of the udder which can reduce the quality and quantity of milk produced by the cow and cause serious damage to the udder. Certain types of mastitis may, indeed, be fatal. The great bulk of the antibiotic is excreted during the first two days following treatment, but traces may be found in the milk for some days afterwards.

In January, 1960, the Milk Hygiene Sub-Committee decided to undertake a survey to determine the incidence of penicillin and other antibiotics in milk. Detailed preparations for the survey were made throughout 1960 involving the selection of a statistically representative sample of the milk supply in Great Britain, the choice of a suitable test for antibiotics, arrangements for the supply of media and cultures, and of milk free from antibiotics and for the training of laboratory staff. By the end of 1960 preparations were complete and the survey was begun in January, 1961. The scope and results of the survey together with recommendations are set out in the attached report.

The Sub-Committee wishes to acknowledge with gratitude the help received from 23 dairy companies, the North of Scotland College of Agriculture, the West of Scotland Agricultural College, the Milk Marketing Board for England and Wales and the advisory bacteriologists of the Ministry of Agriculture, Fisheries and Food in sampling, testing and reporting on the milk included in the survey. Special thanks are due to United Dairies, Ltd., for all media and cultures used in the tests, for a supply of milk free from antibiotics and for training laboratory workers in the techniques employed. The Sub-Committee also wishes to thank those representatives of dairy firms and manufacturers of antibiotics who assisted at its meetings, the National Institute for Research in Dairying, the Hannah Dairy Research Institute, the Central Veterinary Laboratory of the Ministry of Agriculture, Fisheries and Food, and the Ministry's statisticians.

## ANTIBIOTICS IN MILK IN GREAT BRITAIN

### PRESENT SITUATION

1. The widespread use of antibiotics in the treatment of mastitis—inflammation of the udder—has given rise to problems in the dairy industry and may be creating a possible public health hazard due to traces of antibiotics being present in the milk. A survey to find the incidence of antibiotics in ex-farm milk, sold by wholesale, on its arrival at the creamery was therefore undertaken.

*The penicillin survey*

2. The survey started in January, 1961, in England and Wales, and in February, 1961, in Scotland and continued in each case for twelve months. Milk was sampled and tested at 51 centres in England and Wales and 5 in Scotland, the centres being selected to provide a representative sample of milk from each area.

*Test used*

3. There are many tests available for the detection of antibiotics in milk but they vary in their sensitivity. These tests depend on the inhibition of growth of a sensitive organism. Inhibition can be positively ascribed to penicillin but not specifically to any other antibiotic as yet. Since penicillin was assumed to be the one most frequently used in the treatment of mastitis and therefore most likely to occur in milk, the test chosen was one particularly sensitive to penicillin, being capable of detecting levels as low as 0·01 i.u./ml. Other antibiotics and inhibitory substances shown up by this test cannot be individually identified and for the purpose of this report the term " antibiotics " should be taken to include other inhibitory substances.

*Results of the survey*

4. The results of the survey confirmed that penicillin is the most common antibiotic found in milk.

(a) *England and Wales*

5. Over 41,700 samples were examined during the year and of these 11 per cent, representing 14 per cent of the total milk sampled, contained antibiotics. The lowest incidence, 7·7 per cent, was found in October and the highest, 16·6 per cent, in January. There was a general tendency for the incidence of antibiotics in milk to be higher in winter when the cows were kept inside and lower in summer when they were out at grass. There were also variations from one part of the country to another. The highest average incidence of antibiotics, 14·6 per cent, was found in the south-east and the lowest, 7·5 per cent, in the east midlands.

(b) *Scotland*

6. Over 2,700 samples were examined during the twelve months and of these 9·9 per cent, representing 11·6 per cent of the milk sampled,

contained antibiotics. The lowest incidence, 4·7 per cent, was found in July and the highest, 13·8 per cent, in May.

7. A brief description of the test employed and an analysis of the results of the survey are given in the appendix.

*Antibiotics in consumer milk*

8. Although the survey revealed that only a proportion of ex-farm supplies contained antibiotics at any one time, traces could be expected in most milk sold to consumers since practically all such milk would be bulked before sale.

*Medical opinion*

9. The unanimous view of the medical experts on the Antibiotics in Milk Panel of the Ministry of Health is that the presence in milk of any antibiotic is undesirable because of the possible ill effects on the health of a few individuals in the population. The dangers to health are of three types. Firstly, there is the danger that the consumption of small quantities of antibiotics in milk may result in some people becoming sensitised, so rendering them subject to severe reaction if therapeutic doses of these drugs are required later. Secondly, there is the danger of allergic reaction, particularly skin rashes, appearing in a few people who are already highly reactive to penicillin. Such reactions can result from the consumption of milk containing very small quantities of this antibiotic. Thirdly, as a result of treatment with penicillin, strains of penicillin-resistant staphylococci that cause bovine mastitis are alleged to be increasingly common and there is a danger on this account that any illness such organisms may cause in man will not respond to treatment with penicillin.

*Problems for the dairy industry*

10. Traces of antibiotic in milk present a problem in any manufacturing process involving microbial activity. The cheesemaker is most affected since antibiotics slow down the rate of acidity development in the milk, often resulting in lower quality cheese. The presence of antibiotics also affects the production of fermented milks such as yoghurt or kefir.

## POSSIBLE COURSES OF ACTION

*Reducing the need to use antibiotics*

11. Misuse of the milking machine and poor hygiene predispose to the onset and spread of mastitis. Hence, advice to farmers on these matters could well be intensified in order to prevent the disease and so reduce the use of antibiotics. The National Institute for Research in Dairying and the Central Veterinary Laboratory at Weybridge have both investigated the possibility of improved control of mastitis by hygienic methods. Both centres are now engaged in investigating the practical application of these methods on commercial farms.

**It is recommended that**

(*a*) there should be an anti-mastitis campaign by veterinary surgeons and by all those advising on milk production to encourage better milking techniques and hygienic methods, and (*b*) the work on the control of mastitis by improved hygienic methods being carried out at the National Institute for Research in Dairying and at Weybridge should be intensified.

*Antibiotic formulations*

12. Many factors affect the rate of elimination of antibiotics from the udder and it is not possible to provide a standard preparation that would suit all cases of mastitis. Nevertheless, for the treatment of the majority of cases, it should be possible for manufacturers to agree to provide suitable formulations with an excretion time of less than 48 hours, although there will of course be cases where longer excretion times will be necessary. Manufacturers could also help by labelling their preparations with an instruction to withhold the milk from treated animals for a stated number of hours. The Association of the British Pharmaceutical Industry has been approached on these matters and has indicated its willingness to discuss them.

**It is recommended that**

(*a*) manufacturers should be asked to provide formulations suitable for the treatment of the majority of cases of mastitis and having an excretion time of less than 48 hours, and

(*b*) manufacturers should label their preparations to show the minimum length of time that milk from treated animals should be withheld.

*Control of supply of antibiotics to farmers*

13. The law prohibits the sale of antibiotics for the treatment of animals except through veterinary surgeons, and the usual practice is for veterinary surgeons to bring enough antibiotic with them to enable farmers to continue treatment. Veterinary surgeons could assist in reducing the amount of antibiotics likely to be present in milk by restricting the quantity they leave with farmers. They could also impress upon farmers the importance of keeping back milk from treated animals for the period stated on the label. Notification to the buyer that antibiotic treatment had been given would also be helpful as it would enable a check to be kept on milk from that farm. The British Veterinary Association has been asked informally whether its members would co-operate in this way and has indicated that it could not agree with the suggestion regarding notification which would, in its view, be a breach of professional etiquette. The Association has agreed however to do everything possible to see that farmers are reminded of their obligations with regard to disposal of milk from treated animals, and it would like to see prominently displayed on labels of antibiotic preparations the period of time within which the antibiotic is likely to remain in the milk.

14. It has been suggested that only veterinary surgeons should administer antibiotics to cows but in the Sub-Committee's view this is impracticable. Treatment may be necessary on successive days and it would be unrealistic, as well as costly to the farmer, to expect the veterinary surgeon to return each day to give such treatment. Insistence on this might result in farmers using quack remedies to their cost. The injection of the contents of a tube of antibiotic into the udder through the teat is a relatively simple operation

capable of being carried out by any competent farmer or cowman. Further, immediate treatment is essential to prevent a serious outbreak and veterinary surgeons cannot be expected to be always available to meet such urgent cases. The farmer can give "first aid" treatment and the veterinary surgeon confirm the diagnosis and treatment when he visits the farm later.

**It is recommended that**

(*a*) veterinary surgeons should restrict to a minimum the amount of antibiotic preparation they supply to a farmer, and

(*b*) veterinary surgeons should warn farmers that they must withhold the milk from treated animals for the period stated on the label of the antibiotic preparation used.

### *Requirements of the Milk Marketing Boards' contracts*

15. At present the Milk Marketing Board for England and Wales has a clause in its contract with the producer requiring him "not to deliver any milk produced from a cow that shows any symptom of disease of the udder, or is undergoing treatment of the udder by chemotherapy, or has had its udder treated with antibiotics less than 48 hours before such production". The Scottish Milk Marketing Board requires retention of milk from treated animals for 72 hours; the other two Boards in Scotland do not have contracts with their producers, but recommend the withholding of milk from treated animals for 72 hours. In other countries even longer periods of retention are stipulated. The survey results suggest that neither in England and Wales nor in Scotland is the contract requirement being observed. The Boards should give more publicity to the importance of a milk supply free from antibiotics and urge upon milk producers the need to comply with the requirement to keep back milk from treated animals for the period stated. This milk need not be wasted; it can be fed to young stock. Since in some instances cows need to be treated with preparations of longer excretion times than 48 hours, it is suggested that the Milk Marketing Boards should amend the clause in their contracts to take account of the excretion times of different preparations.

**It is recommended that** following the implementation of the recommendation in paragraph 12 (*b*) the Milk Marketing Boards should require producers to withhold milk for the period shown on the label of the antibiotic preparation used.

### *The use of markers to detect the presence of antibiotics*

16. A good deal of work has been done on the use of dyes as markers in antibiotic preparations to indicate when it is safe to send the milk forward, i.e., if the milk is visually free from traces of dye it can be assumed that it is safe to include it in the bulk. However, traces of dye and antibiotics may still be present in the milk even when the dye cannot be detected visually and these traces of dye can discolour cheese and dried milk. Such traces could be detected by a special test at the creamery, but this would mean that every can of milk would have to be tested every day—an impossible task. So the use of dyes as markers, at least in this country at present, does not seem to be a practical proposition. Nevertheless, a

suitable marker of quick and easy detection would be most useful for indicating the presence of antibiotics.

> **It is recommended that** the search for a suitable marker—not necessarily a dye—capable of quick and easy detection should be continued.

*Testing for the presence of antibiotics*

17. Whether a marker is used or not, if the buyer is to be sure that his incoming supplies are free from antibiotics he must test every can every day. This is an impossible burden to place on any creamery and the most that one can expect is a periodic check on cans selected at random. Tests at present are microbiological in nature and the quickest takes at least two hours and requires a certain amount of skill and special equipment. Nevertheless it is felt that first-hand buyers of milk could contribute greatly to the control of antibiotics in the milk supply if they were periodically to sample and test for their presence. It is suggested that milk found to contain antibiotics should incur a price penalty as is proposed by the Scottish Milk Marketing Board.

**It is recommended that**

(*a*) buyers should carry out periodic checks on incoming milk, and

(*b*) the other Milk Marketing Boards should consider introducing a system of price penalties for milk found to contain antibiotics on the lines proposed by the Scottish Milk Marketing Board.

*Action under the Food and Drugs Act, 1955, and the Food and Drugs (Scotland) Act, 1956*

18. The food and drugs authorities in Canada and the United States regard the presence of penicillin in milk as adulteration, but the position in Great Britain is not clear. Under section 2 of both the Food and Drugs Acts, it is an offence to sell to the prejudice of the purchaser any food which is not of the nature, substance or quality demanded. The presence in milk of an antibiotic might be held to be an offence under these sections but, since so far as is known no case based on the presence of an antibiotic has yet been taken, no interpretation of the law in this respect is available.

> **It is recommended that** food and drugs authorities should be encouraged to sample and test ex-farm milk for the presence of antibiotics and to take appropriate action.

*Publicity*

19. The presence of antibiotics in milk can be a hazard not only from the medical aspect but also for the manufacturer of milk products. Producers therefore need to be constantly reminded of their obligation to keep back milk from treated animals. The importance of proper management of the milking machine and good hygiene in preventing the onset and spread of mastitis should also be stressed. To attain these ends publicity is essential. It is suggested that the Milk Marketing Boards and others concerned should draw the attention of milk producers to these matters

in their own publications and also inspire articles in the national agricultural press and local county papers. Placards for display in cowsheds should also be provided. Only if the problem is kept constantly before the producers concerned can the objective of a milk supply free from traces of antibiotics be obtained.

> **It is recommended that** there should be a publicity campaign to ensure that producers are constantly reminded of the necessity to observe all precautions in order that the milk supply shall be free from traces of antibiotics.

## SUMMARY OF RECOMMENDATIONS

(1) There should be an anti-mastitis campaign by veterinary surgeons and by all those advising on milk production to encourage better milking techniques and hygienic methods.

(2) The work on the control of mastitis by improved hygienic methods being carried out at the National Institute for Research in Dairying and at Weybridge should be intensified.

(3) Manufacturers should be asked to provide formulations suitable for the treatment of the majority of cases of mastitis and having an excretion time of less than 48 hours.

(4) Manufacturers should label their preparations to show the minimum length of time that milk from treated animals should be withheld.

(5) Veterinary surgeons should restrict to a minimum the amount of antibiotic preparation they supply to a farmer.

(6) Veterinary surgeons should warn farmers that they must withhold the milk from treated animals for the period stated on the label of the antibiotic preparation used.

(7) Following the implementation of recommendation (4) the Milk Marketing Boards should require producers to withhold milk for the period shown on the label of the antibiotic preparation used.

(8) The search for a suitable marker—not necessarily a dye—capable of quick and easy detection should be continued.

(9) Buyers should carry out periodic checks on incoming milk.

(10) The other Milk Marketing Boards should consider introducing a system of price penalties for milk found to contain antibiotics on the lines of that proposed by the Scottish Milk Marketing Board.

(11) Food and drugs authorities should be encouraged to sample and test ex-farm milk for the presence of antibiotics and to take appropriate action.

(12) There should be a publicity campaign to ensure that producers are constantly reminded of the necessity to observe all precautions in order that the milk supply shall be free from traces of antibiotics.

## THE PENICILLIN SURVEY

### *Introduction*

1. The object of this survey was to obtain information on the incidence of antibiotics in ex-farm milk on its arrival at creameries. The sampling points were selected on a statistical basis and covered over 20 per cent of producers scattered throughout England and Wales. The number of producers tested each month was well over 3,000. Samples taken were representative of the daily production from each farm.

### *The test used in the survey*

2. The test known as the TTC (2:3:5 triphenyl-tetrazolium chloride) test used in the survey was very sensitive, being capable of detecting levels of penicillin as low as 0·01 i.u./ml whereas routine plate methods are normally only capable of detecting levels of the order of 0·05 i.u./ml. The test depends on the fact that the growth of a sensitive organism—streptococcus thermophilus BC—is inhibited by the traces of penicillin in the milk under examination, the inhibition being indicated by the failure of the TTC to change from its colourless or leuco form to the red colour of formazone. Thus a red colour indicated the absence of antibiotic whereas no change or the appearance of faintly red colours indicated the presence of antibiotic. The presence of penicillin was confirmed by adding penicillinase to duplicate tubes set up at the same time. By matching the colours against prepared standards an estimate of the level of penicillin present could be obtained. The test also indicated the presence of other antibiotics and inhibitory substances.

### *Results of the survey*

3. The results were expressed in terms of a range of international units of penicillin per ml of milk varying from 0·01 to 1·5 and over, and showed the number and percentage of samples falling into each range together with the corresponding gallonage of milk involved. Results were collected on a monthly basis so that any seasonal variation could be detected. They were also summarised on the basis of the Milk Marketing Board's regions in order to see what, if any, variation in levels occurred in different parts of the country. The results over the twelve months' period for England and Wales and for Scotland are summarised in Table 1.

4. In England and Wales over 41,700 samples were examined during the twelve months and of these 11 per cent, representing 14 per cent of the total gallonage of milk sampled, contained antibiotics. The lowest incidence of 7·7 per cent occurred in October and represented 10·2 per cent of the milk sampled. The highest incidence, 16·6 per cent, representing 21·3 per cent of the milk sampled, occurred in January.

5. Study of the figures for the Milk Marketing Board's regions shows that the South-Eastern region had the highest average incidence of antibiotics in milk, 14·6 per cent, representing nearly 17 per cent of the milk sampled in the region. The East Midland region had the lowest average incidence with 7·5 per cent, representing 11·1 per cent of the milk sampled. The region with the highest percentage of milk containing antibiotics was the Southern where on average 17·2 per cent of the milk sampled contained antibiotics ranging from a minimum of 8·6 per cent in October to 26·5 per cent in April. At the other extreme the Far West region had the lowest average percentage of milk containing antibiotics, i.e., 10·5 per cent of the milk sampled ranging from 4·1 per cent in November to 18 per cent in January.

6. To sum up, the lowest incidence of antibiotics in milk occurred in the summer and autumn when the cows were out at grass and the highest in winter

when the cows were mainly under cover. The highest incidence of antibiotics occurred in the Southern, South-Eastern, Mid-West and West Midland regions, and the lowest in the East Midlands and Far West.

7. In Scotland, the average level of antibiotics in milk was 9·9 per cent, representing 11·5 per cent of the milk sampled. The incidence varied from 4·7 per cent in July to 13·8 per cent in May and the volume of milk containing antibiotics varied from 5·6 per cent of that sampled in July to 18·7 per cent in November.

8. Table 2 shows the calculated average amount of penicillin in i.u./ml of milk for each month of the survey in each Milk Marketing Board region and in Scotland on the assumption that all milk is bulked before being sold to the public. The figures show a satisfactory degree of consistency. The general pattern is of a fall from March to September followed by a rise.

9. It will be seen that the penicillin content of milk was highest in the South-Eastern region, which supplies London, and in the West Midlands, which supplies Birmingham. These two regions have curiously dissimilar seasonal patterns. The South-Eastern trend was similar to but much more pronounced than the national one, with a maximum in February and March and a minimum in September, when it even fell below the national average. The West Midlands, on the other hand, recorded a maximum in October. The South, the Mid-West, South Wales and the Northern counties all stayed below the national average for eleven of the twelve months. These regional differences are significant but cannot at present be fully explained.

10. The results indicate that two distinct patterns emerge. Firstly, there are indications that some producers have not withheld milk for 48 hours or 72 hours after treatment as the case may be, and, secondly, that even after the expiration of 48 hours all penicillin had not always been excreted.

## TABLE 1
### INCIDENCE OF ANTIBIOTICS IN MILK

| England and Wales | | | | | Scotland | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total January–December, 1961 | | | | Total February, 1961–February, 1962* | | | | |
| Range i.u. per ml | Number of samples | Per cent of total | Gallons | Per cent of total | Number of samples | Per cent of total | Gallons | Per cent of total | Range i.u. per ml |
| 1. 0·00 and under 0·01 ... | 37,100 | 88·92 | 1,722,398 | 85·99 | 2,473 | 90·12 | 198,260 | 88·44 | 0·00 and under 0·01 |
| *Penicillin*<br>2. 0·01 and under 0·02 ... | 931 | 2·23 | 50,206 | 2·51 | 34 | 1·24 | 3,838 | 1·71 | *Penicillin*<br>0·01 and under 0·02 |
| 3. 0·02 and under 0·03 ... | 487 | 1·17 | 31,685 | 1·58 | 32 | 1·17 | 2,897 | 1·29 | 0·02 and under 0·03 |
| 4. 0·03 and under 0·04 ... | 434 | 1·04 | 29,514 | 1·47 | 19 | 0·69 | 1,620 | 0·72 | 0·03 and under 0·04 |
| 5. 0·04 and under 0·05 ... | 223 | 0·53 | 14,829 | 0·74 | 19 | 0·69 | 2,278 | 1·02 | 0·04 and under 0·05 |
| 6. 0·05 and under 0·075 ... | 394 | 0·94 | 27,527 | 1·38 | 22 | 0·80 | 2,792 | 1·24 | 0·05 and under 0·075 |
| 7. 0·075 and under 0·1 ... | 502 | 1·20 | 35,322 | 1·76 | 16 | 0·58 | 1,970 | 0·88 | 0·075 and under 0·1 |
| 8. 0·1 and under 0·2 ... | 493 | 1·18 | 33,004 | 1·65 | 45 | 1·64 | 3,607 | 1·61 | 0·1 and under 0·2 |
| 9. 0·2 and under 0·3 ... | 169 | 0·41 | 11,461 | 0·57 | 13 | 0·47 | 1,275 | 0·57 | 0·2 and under 0·3 |
| 10. 0·3 and under 0·5 ... | 366 | 0·88 | 21,380 | 1·07 | 30 | 1·10 | 2,347 | 1·05 | 0·3 and under 0·5 |
| 11. 0·5 and under 1·0 ... | 80 | 0·19 | 4,279 | 0·21 | 6 | 0·22 | 492 | 0·22 | 0·5 and under 1·0 |
| 12. 1·0 and under 1·5 ... | 28 | 0·07 | 1,385 | 0·07 | 4 | 0·15 | 265 | 0·12 | 1·0 and under 1·5 |
| 13. 1·5 and over ... ... | 32 | 0·08 | 1,697 | 0·08 | 2 | 0·07 | 151 | 0·07 | 1·5 and over |
| 14. Other antibiotics including inhibitory substances. | 482 | 1·16 | 18,361 | 0·92 | 29 | 1·06 | 2,380 | 1·06 | Other antibiotics including inhibitory substances. |
| Totals 2–14 ... | 4,621 | 11·08 | 280,650 | 14·01 | 271 | 9·88 | 25,912 | 11·56 | Totals 2–14 |
| Totals 1–14 ... | 41,721 | 100·00 | 2,003,048 | 100·00 | 2,744 | 100·00 | 224,172 | 100·00 | Totals 1–14 |

* The Scottish table covers a period of thirteen months because one creamery started in March, 1961, and went on to February, 1962, to complete its twelve months of testing.

## TABLE 2

### CALCULATED AVERAGE AMOUNTS OF PENICILLIN IN i.u./ml OF MILK IN EACH MONTH IN EACH MILK MARKETING BOARD REGION AND IN SCOTLAND

| | 1961 | | | | | | | | | | | | | 1962 | | Feb., 1961 Feb., 1962* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan.–Dec., Year | Jan. | Feb.* | |
| 1. Northern ... | ·0145 | ·0199 | ·0230 | ·0159 | ·0051 | ·0073 | ·0090 | ·0109 | ·0063 | ·0062 | ·0142 | ·0052 | ·0119 | | | |
| 2. North-Western | ·0341 | ·0315 | ·0202 | ·0267 | ·0185 | ·0210 | ·0148 | ·0064 | ·0039 | ·0184 | ·0163 | ·0148 | ·0192 | | | |
| 3. Eastern ... | ·0242 | ·0232 | ·0319 | ·0067 | ·0108 | ·0017 | ·0095 | ·0109 | ·0103 | ·0086 | ·0264 | ·0165 | ·0155 | | | |
| 4. East Midland | ·0129 | ·0088 | ·0145 | ·0112 | ·0222 | ·0074 | ·0194 | ·0194 | ·0092 | ·0115 | ·0138 | ·0228 | ·0145 | | | |
| 5. West Midland | ·0267 | ·0166 | ·0252 | ·0134 | ·0186 | ·0186 | ·0213 | ·0222 | ·0226 | ·0417 | ·0198 | ·0245 | ·0222 | | | |
| 6. North Wales | ·0180 | ·0290 | ·0208 | ·0098 | ·0110 | ·0339 | ·0412 | ·0048 | ·0173 | ·0032 | ·0079 | ·0245 | ·0183 | | | |
| 7. South Wales | ·0176 | ·0186 | ·0205 | ·0044 | ·0156 | ·0141 | ·0088 | ·0078 | ·0032 | ·0068 | ·0126 | ·0052 | ·0116 | | | |
| 8. Southern ... | ·0096 | ·0153 | ·0228 | ·0110 | ·0089 | ·0051 | ·0035 | ·0108 | ·0062 | ·0099 | ·0058 | ·0192 | ·0105 | | | |
| 9. Mid-West ... | ·0154 | ·0105 | ·0142 | ·0103 | ·0077 | ·0083 | ·0067 | ·0083 | ·0069 | ·0204 | ·0072 | ·0102 | ·0104 | | | |
| 10. Far West ... | ·0150 | ·0221 | ·0189 | ·0306 | ·0098 | ·0207 | ·0200 | ·0247 | ·0127 | ·0061 | ·0101 | ·0081 | ·0168 | | | |
| 11. South-Eastern | ·0328 | ·0362 | ·0331 | ·0188 | ·0306 | ·0225 | ·0145 | ·0133 | ·0048 | ·0182 | ·0193 | ·0278 | ·0229 | | | |
| 12. England and Wales | ·0221 | ·0230 | ·0241 | ·0158 | ·0160 | ·0139 | ·0128 | ·0120 | ·0076 | ·0145 | ·0144 | ·0155 | ·0161 | | | |
| 13. Scotland ... | | ·0245 | ·0124 | ·0112 | ·0082 | ·0281 | ·0047 | ·0231 | ·0159 | ·0091 | ·0124 | ·0231 | | ·0161 | ·0036 | ·0153 |

* The Scottish figures relate to a period of thirteen months because one creamery started in March, 1961, and went on to February, 1962, to complete its twelve months of testing.

(81119) Wt. 3648—4629 K24 2/63 St.S.